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Mixed-dominance and its relationship to the gross-motor skills of primary, school-aged children

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MIXED-DOMINANCE AND ITS RELATIONSHIP TO THE GROSS-MOTOR SKILLS OF PRIMARY, SCHOOL-AGED CHILDREN

by

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This paper is dedicated to my teachers: Desiree, Andrew, Michelle, Craig, and the numerous children in my life who have taught me how difficult learning can be.

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INTRODUCTION

Despite the wealth of knowledge in the field of education, including child development and learning theories, the expectations of children entering educational settings today are basically the same as they have been throughout the history of compulsory education.

By the age of six, children are expected to be able to deal effectively with their environment both motorically and perceptually. In the beginning stages of life, the normal child learns how to contact the environment through random movement. Eventually, the child learns how to control motoric responses. One of the effects of such movement is perceptual knowledge which contributes to a growing body of information within the child (Kephart, 1971).

Because normal development follows sequential stages of growth, it is reasonable to assume that the perceptual information that the child receives is directly dependent on how the child has progressed through the motor stages. Good motor development is necessary for normal achievement in many areas.

Most children entering school for the first time have not yet established lateral dominance. They are still unsure of which hand to use for certain tasks, which foot to kick with and their eye-hand coordination is poor, often indicating that they have not yet established a dominant hand, eye, and/or foot. It can be stated that children at this stage have confused dominance. Through maturity and additional training, most children develop lateral dominance. However, some children have difficulty with this stage of development and lateral dominance is not established. They do not show a consistent preference for one eye, hand, or foot. The dominant hand and the dominant eye may be on opposite sides of the body or the dominant eye and foot or hand and foot may be on opposite sides of the body. Instead of passing from the stage of confused dominance to lateral dominance, the child has replaced confused dominance with mixed dominance. Children with mixed dominance experience inadequate motor responses in areas such as relationship to gravity, laterality, and overall coordination (Kephart, 1968).

For such a child, the inner world is unstable and unreliable (Lerner, 1971). This will, of course, be reflected in academic work but will also be reflected in areas of gross motor activity. Children who are confused in the accurate perception of their bodies often experience directional confusion and this is reflected in an inability to successfully participate in motor activities. This

can be devastating to a child whose standing among peers depends very much on skill at games and other activities requiring motor organization. Just as most children receive satisfaction from academic achievement, so too they can receive great satisfaction from skilled physical activity.

Purpose of the Paper

The purpose of this paper was to investigate the area of mixed dominance as it relates to the gross-motor skills of primary, school-aged children.

Research Questions

What are the separate functions of the two cerebral hemispheres and how do they relate to each other?

What are some of the popular beliefs regarding mixed dominance?

What is the effect of mixed dominance on gross-motor skills?

What are some of the approaches used to aid in establishing lateral dominance and do they improve gross-motor skills?

Definition of Terms

Cerebral Dominance--Frequently referred to as hemispheric specialization. It reflects the asymmetrical functions of the two hemispheres. The term implies that the higher functions of the brain are located predominantly in one hemisphere.

Mixed Dominance--Having established dominance for particular functions but not showing a consistent preference for one eye, hand, or foot. This definition also includes crossed dominance.

Crossed Dominance--The dominant hand and the dominant eye are on opposite sides of the body.

Laterality--The inner knowledge or the complete motor awareness of two sides of the body and the ability to automatically call forth the one needed for a particular task. Laterality lays the basis for the horizontal dimensions of space within the person and in later stages is projected onto outside spaces and objects so that they too have a right and left dimension.

Gross Motor Skill--Refers to the muscular movement of the body required for the successful execution of a desired act. Gross refers to a quality opposed to fine; usually involves the movement of the whole body. Motor implies movement. Skill implies that some learning has taken place prior to

the actual execution of the motor act. Reference should be made to the nature of the task and the status of the performer. For instance, a normal adult would not be considered skilled just because he/she can run or walk, but for an eight month old child who is walking, this would be considered an extremely skilled act.

Body Image--The awareness of one's own body and the relationship of the body parts to each other and to the outside environment. Body image is the point of origin for all spatial relationships among objects in space. Adequate body image is the foundation for the development of laterality and balance.

Summary

This chapter presented information relating to the various stages of development that children must pass through in order to be ready to successfully meet the expectations of the educational system. If children do not acquire certain skills at specific stages, future skills become more difficult to acquire. Some children do not develop lateral dominance and this can have a direct

effect on how children perform motor tasks. Lack of adequate gross-motor skills can greatly influence how children feel about themselves and how they relate to other people.

Following the statement of the purpose of the paper, several research questions were stated regarding the functions of the two cerebral hemispheres, popular beliefs pertaining to mixed dominance, the effects of mixed dominance on gross-motor skills, and various approaches used to aid in establishing lateral dominance. In addition, several definitions were set forth directly related to the topic of this paper.

Chapter II will present a review of the research relative to Chapter I.

CHAPTER II

REVIEW OF RESEARCH

Introduction

Chapter II presents a review of the research on mixed dominance as it relates to motor skills. The first section deals with background information on the functions of the two cerebral hemispheres. This aids in understanding how and perhaps why mixed dominance develops in some people. The remaining sections of Chapter II discuss popular beliefs regarding mixed dominance, how it relates to and affects the gross-motor skills of children, and how it can be prevented in the course of development.

The Human Brain

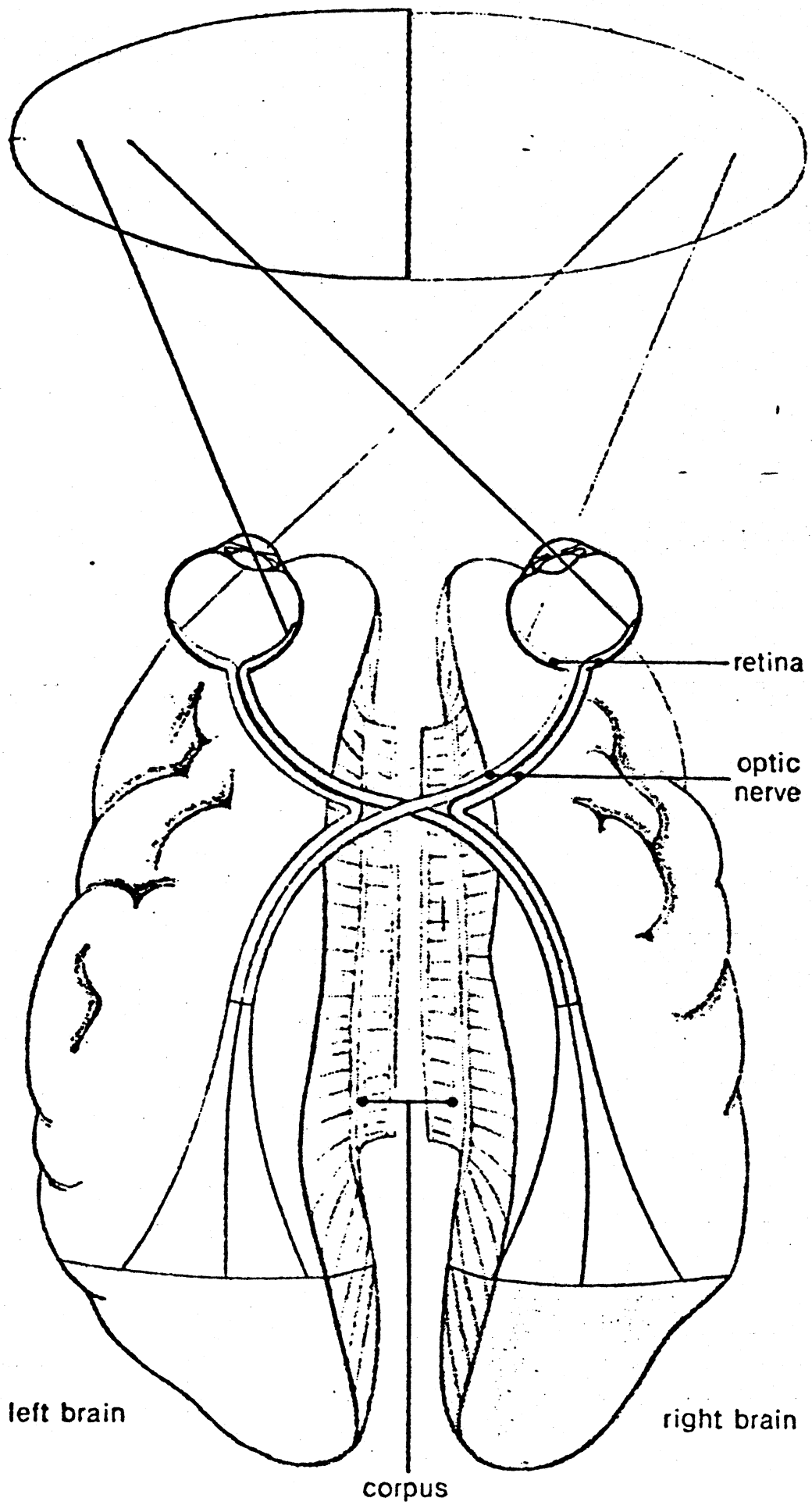
The human brain is the most complex form of matter known. It has been a subject of wonder and research for centuries. The knowledge that has been accumulated through years of study and experimentation has revealed fascinating facts and assumptions regarding the functions and possible potentials of the human brain.

A relatively recent fact concerning the make-up of the brain is the existence of not merely one whole brain controlling human behavior but of two separate brains,

each having its own crucial functions and capabilities. These two brains are interconnected and each provides a significant role in the creative process. For the purpose of this paper, the writer presents the separate functions of each side of the brain and refers to the brain with such terms as the left brain and the right brain, designating the left and right sides of the brain.

In most animals, the two sides of the brain are similar, and damage to one side will not result in the loss of a specific skill. In humans, however, this is not necessarily true. When one side is damaged, certain capabilities are lost. They can be learned by the other hemisphere but in many cases this is a very difficult task (Bailey, 1975).

Probably the best way to understand the functions of the two brains is through a study of split-brain experiments. The term, split-brain, refers to the actual existence of two totally separate brains. The human brain is connected by a bunch of nerve fibers called the corpus callosum. This connection allows information to be passed from one side of the brain to the other. In a split-brain, what both eyes see on the left field of vision goes via both eyes to the right side of the brain and vice versa. The split in the brain (caused by the severance of the corpus callosum) prevents the normal exchange of information between the two sides of the brain (Calder, 1970). For a graphic description of the split-brain, see figure 1.


left visual field
right visual field
retina
optic nerve
left brain
right brain
corpus

As early as 1930, neurosurgeons had been experimenting with the brain in an attempt to help control seizures resulting from epilepsy. Additional split-brain experiments done on animals prompted an American psychologist, Roger Sperry, to explore the words of the split-brain (Bailey, 1975).

The separate functions of the two brains became apparent through tests and experiments following the severance of the corpus callosum. Simply speaking, the left brain controls verbal behavior and the right brain controls nonverbal behavior. The left brain excels in performing routine, sequential tasks; it follows a course of logical reasoning. The right brain, on the other hand, processes information all at once. Because of its skill with logical reasoning, the left brain excels in areas such as language, writing, math, and science (Wheatley, 1978). The right brain tends to surpass the left in areas of music, art, and athletics. It is interesting to note that the right brain can also comprehend words when spoken because, unlike the sense of touch, the sense of hearing communicates with both hemispheres (Bailey, 1975). This belief became known through a series of studies done by Sperry and his colleagues in the 1970's. When test subjects were asked to retrieve objects from a bag with their left hands (right brains), they could easily find the appropriate objects. They could also locate the correct objects when they were merely described and not named (Bailey, 1975). This and other

studies indicate that the right brain retains the skills of comprehension, perception, and memory. The right brain is also superior with tasks involving visual perception. It is aware of the body's orientation in space. The right brain possesses a keen sense of shape, form, and texture (Calder, 197). The case of a woman who had undergone a split-brain operation to control epilepsy supports this idea: Seated behind a screen, the woman was asked to use her left hand (right brain) to feel objects and name them. She could not name them because the right brain does not control speech. However, the right brain is much more skilled at recognizing objects through touch if it can identify them in terms other than language (Calder, 1970).

Importance of the Right Brain

Initially, research done on the human brain emphasized the "superior" abilities of the left brain while minimizing the abilities of the right brain. The left brain has the ability to write and speak; it is literate and analytical and thus tends to dominate personality. However, through studies of the split-brain, the nature of the capability of the right brain has been revealed. It should be realized that only through the integration of the intelligent left brain and the intuitive right brain has humankind been able to achieve the greatest potential. How the two brains collaborate to control behavior is best understood through their abilities to solve a visualization problem.

The right brain, being the site of creative thought, provides the idea and is thus more important in the first phase of problem solving. It mulls over the problem in a non-direct way, forming a plan. Since the left brain is better at sequential tasks and has the appropriate reasoning skills, it takes over in the second phase of problem solving, that is, applying a chosen answer. The total problem is then viewed collectively to test the reasonableness of the solution. In general, the left brain analyzes and pays more attention to detail while the right brain grasps the whole and solves at once. In addition, the left brain processes information in a way that it can be described in language (Wheatley, 1978).

According to Wheatley (1978), our educational curriculum stresses "rule-oriented sequential activities" so much that children expect to apply a rule immediately to a problem. In other words, our educational system encourages left brain work and thus encourages left brain dominance (Wheatley, 1978). It should be remembered that words are not the only medium for knowledge. One can "know" without relating thoughts in words. Albert Einstein seemed to understand the importance of the right brain when he stated "A thought comes and I may try to express it in words afterwards" (Bailey, 1978, p. 91). Nearly all discoveries in every field began with imagination, a sudden idea, an instantaneous intuition provided by the right brain. Only after the right brain provides the idea can the left brain analyze and explain it.

In conclusion, from research of the brain and particularly that of the split-brain, it is obvious that the two brains have separate responsibilities in controlling human behavior. The potential of the right brain should not be undermined in its relation to the left brain. Further research indicates interesting ideas regarding the two brains which will not be dealt with in detail at this point. Some studies have indicated that in adults, damage to the left brain can destroy the ability to use words as symbols of ideas, and damage to the right brain can affect the ability to discriminate shapes, sounds, and textures. Of great interest is the fact that in young children, damage to the left brain will possibly not retard language development. So it seems that the two brains are of relatively equal potential in young children and, in a great majority, the left gradually becomes dominant for language (Beadle, 1970).

Hemispheric Specialization

The idea of the right and left brains having separate functions has led to much investigation and speculation which in turn has led to controversy in the various fields of research. One dimension of brain-behavior relationships which is quite controversial is that of hemispheric specialization of function--frequently referred to as cerebral dominance.

According to Oliver Zangwill of England's Cambridge University, a leading expert on the subject, the origin of cerebral dominance is based on the discovery that loss of speech almost always results from a left brain lesion and this suggests a possible link with handedness. The idea then became popular that both right-handedness and lateralization of speech are due to an innate pre-eminence of the left brain. It was felt that this position would be reversed in sinistrals (left-handed people). Because of this assumption, the dominant brain came to be accepted as that which is contralateral to the preferred hand (Zangwill, 1962). This assigns a simple explanation to the concept of cerebral dominance: if the left brain controls the right side of the body and the right brain controls the left side of the body, then it is reasonable to assume that the right brain is dominant for left-handers and vice versa. However, further research indicates that this is inadequate.

Regarding left-handers, Zangwill discovered that the right brain is not dominant for all left-handers. More than 50 percent of left-handers have dominant left brains. Through observations, he noted that left-handers frequently exhibit ambidextral tendencies such as writing with the left hand and throwing a ball with the right. This led Zangwill to suggest that left-handers may have ambidextral brains with neither brain as dominant as the left brain is for right-handers. If this is so, then language and

writing abilities are not firmly lodged in one specific brain (Zangwill, 1962).

At this point it is necessary to explain the term "ambidextrous." True ambidexterity exists when all skills on the two sides are not only equal but highly developed. This is hardly possible since human development in manual skills reveals a tendency for the preferential use of one hand. It has been suggested that the so-called ambidextrous person is usually a native sinistral who has acquired a considerable measure of skill in certain right-sided activities probably through training (Orton, 1937).

In support of Zangwill's findings regarding the incidence of left brain dominance and right-sided preference, Marcel Kinsbourne found that 95 percent of the total population is right-handed and left lateralized for speech. Left-handers and those with mixed-sidedness comprise the other 5 percent and they are also left lateralized for language two-thirds of the time and right lateralized for language one-quarter of the time and possibly bilaterally organized for language in the remaining one-twelfth of the instances (Kinsbourne, 1975).

Statistics such as these are based on split-brain studies and also on studies in which sodium amytol (a fast-acting barbituate) was injected into the arterial system supplying one side of the brain. This is frequently called the Wada Technique (Wada and Rasmussen, 1960). This strategy has limited the study of hemispheric specialization

in children. At this time, there appears to be more information available on the adult brain. Even through the use of sodium amytol, the statistics regarding brain dominance and sidedness vary.

Onset of Hemispheric Specialization

There are also varying opinions regarding the onset of hemispheric specialization. According to studies of brain damaged children and adults, it seems that left hemispheric specialization for linguistic processing is present at least by five years of age (Annett, 1973). However, other recent evidence indicates that left-brain specialization for language is probably present at birth--at least for certain linguistic processes that infants are capable of such as phonemic discrimination (Eimas, Jusczyk, Siqueland, and Vigorito, 1971). The data to support this comes from asymmetry in ear scores on dichotic listening tests (Entus, 1975), hemispheric asymmetry in cortical evoked responses to speech and nonspeech stimuli in infants (Molfese, Freeman, and Palermo, 1975), and findings that anatomical asymmetry between the hemispheres in a language mediating area exists in newborns (Wada, Clarke, and Hamm, 1975; Witelson and Pallie, 1973) as in adults (Geschwind and Levitsky, 1968). The available recent research tends to indicate that hemispheric specialization is present at birth and out of this develops laterality, the sidedness of an individual.

Lateral Dominance

How lateral dominance develops is somewhat controversial also. Oxendine states two major beliefs regarding the development of lateral dominance, the first being that it is inherited. The second belief is that it is developmental--all normal children can develop either a right or left dominance with appropriate training from birth (Oxendine, 1968). For example, left-handedness decreases sharply from infancy to adulthood; young children show an inconsistency in handedness (Hildreth, 1949).

Research into this topic would not be complete without reference to the work of Samuel Orton, a neurologist and neuropathologist. His basic research related language disabilities in children to an incomplete development of superiority in the dominant hemisphere (Kinsbourne and Hiscock, 1978). The laterality of an individual is often an indication of the dominant hemisphere--but not always. Evidence shows that nearly all right-handers are left lateralized for language but left-handers are more heterogeneous in language representation. The majority of left-handers (two-thirds) have left-lateralized language. The remaining sinistrals seem to be right-lateralized for language and some have linguistic capabilities in both hemispheres. So one cannot make a safe statement concerning hemispheric specialization for left-handers. The best bet, though, would be left hemispheric specialization (Orton, 1937).

Orton contends that at birth the infant has no unilateral superiority in control of either hand or language. In support of this, Orton (1937) refers to Pierre Marie's statement that there is no greater incidence of a speech disorder in children who have suffered a birth paralysis involving the right hand than when it involves the left. According to Orton, Marie inferred that neither the right nor the left brain is predestined for speech control and if one brain is damaged, the other can easily take control. However, Orton believes that most children do carry a hereditary tendency to develop predominant use of either the right or left brain. Handedness itself is very open to the effects of training. The patterns one finds are a result of heredity and training and both factors will vary in degree (Orton, 1937).

Mixed Dominance and Motor Patterns

It is difficult to do justice to the mass of information available on hemispheric specialization and lateral dominance and how these conditions relate to human behavior. They are controversial topics. Claims and counter-claims concerning mixed dominance have been limited largely to language function. Differences in learning to read and write, including the problem of reversals, have been traced to mixed dominance. However, there is a limited amount of information relating gross-motor skllls to mixed dominance.

Body Image

Kephart (1968) emphasized the importance of motor skills in the total development of the child. Basic information originates in motor exploration. Kephart recognized the importance of learning laterality by experimenting through movement. It is thus important that the child distinguish motor activities on the right side of the body from those on the left side of the body. In addition, the child must learn to shift easily from one side to the other.

According to Kephart, the first direction to develop is laterality. The body is bilaterally symmetrical and therefore it seems natural for it to detect left and right. Following the development of laterality is balance. However, even before laterality is developed, a child must develop a functional body image (Kephart, 1971).

It is the opinion of the writer that a child who exhibits mixed or confused dominant motor patterns will likely lack in adequate body image.

Arnheim and Sinclair (1975) stated that children who are confused in the accurate perception of their bodies often have directional confusion and that is reflected in an inability to engage in motor skills. It is quite plausible and understandable that a child with confused dominance would have great difficulty becoming skilled with specific motor acts. According to Jessie Williams, body image is laboriously acquired. "Failure in its normal development, due to deficits in afferent sensory

pathways or to impairment of integration with the cerebrum may be an important contribution to the total disability of a handicapped child" (Williams, 1970, p. 58). Disorders of body image may be the root of early learning problems. Many problems that are manifested as perceptual difficulties are rooted in faulty body image and often have nothing to do with intellectual capabilities (Williams, 1970).

As reported by Wedell (1973), Yule tested a group of children identified as being excessively clumsy. He found 64.5 percent to have difficulty with right-left discrimination when asked to carry out lateralized movements. Only 32 percent of the control group had similar difficulties. A disability in copying lateralized movements has been ascribed to defects in body image. Defective body image in turn has been ascribed to unestablished lateral hand, eye, and foot. The problems a child may encounter while dressing reveals a difficulty with right-left discrimination of movements. This results from failure in the establishment of body image. This in turn suggests that the child does not use his/her own body as a consistent point of reference in organizing movements in space (Wedell, 1973). Children who are neither predominantly right or left sided may have an unusual amount of difficulty in learning which is right and left and the verbal accounts of their handedness may often be contrary to their demonstration of choices. Many are conscious of this and as adults report a history of difficulty with following directions (Orton, 1937).

Dominance: Confused or Mixed?

Combinations of sidedness may occur in any individual and is commonly referred to as "mixed dominance." However, perhaps "confused dominance" is a better term to use to identify those who have not established consistent dominance for any given function. This is the group the writer refers to as having faulty body image, incomplete lateralization, and poor gross-motor skills. A study done by Douglass (1965) explains the possible need for the use of the term "confused dominance." The purpose of this particular study was to explore the relationship between mixed dominance and children's knowledge of directions. Douglass felt that children who exhibit mixed dominance would score less well on a test of directions than children who are dominantly right or left sided. In other words, mixed dominance would confuse children when learning directions and such children would find it more difficult to orient themselves in space. However, the scores obtained from children in the sample indicated that the greater degree of mixed dominance, the better the chances of the children scoring well on a test of directions. Douglass did state that the instruments used were not highly refined but the pattern of scores and their coefficients of correlation were very consistent. These data suggest that mixed dominance may be different from a condition called "confused dominance" (Douglass, 1965). The writer chooses to define confused dominance as a condition

in which consistent dominance has not been established for any given function and mixed dominance as a condition in which dominance has been established for a given function. The fact that dominance for different functions occurs in different hemispheres may be unimportant or, in some instances, helpful (Douglass, 1965).

Developmental Apraxia

Although reference of mixed or confused dominance being related to gross-motor skills is slight, Orton discusses a condition known as Developmental Apraxia. This refers to a failure in the development of normal skills. The term apraxia refers to abnormal clumsiness. According to Orton, this term goes as far back as Galen (Orton, 1937) who spoke of some children as being "ambilevous," that is, doubly left-handed. These children seem to lack skill on both sides. The term ambilevous was used (perhaps unjustly) because this condition seemed comparable to that of the left hand in a right-handed individual. Apraxics show an inability in carrying out complex trained movements whether they be of hand, foot, or body. This difficulty in learning complex movements may also extend to the motor patterns of speech and writing as well as to movements of the body. In spite of attempts to train an individual to

develop a dominant hand, there is a strong suggestion of an even balance between the two hands. Some tests also show a lack of ability in monocular sighting by either eye. People having Developmental Apraxia are often delayed in learning simple movements of walking and running and have much difficulty in learning to use hands and to copy motions shown to them (Orton, 1937). This condition would make the basic everyday skills of buttoning clothes, tying shoes, handling utensils, etc., extremely difficult for such an individual. It is hard to imagine the anguish of a young child who does not understand his/her inability to adequately play games with peers or compete in any motor skills successfully. In addition, a considerable measure of inferiority is unavoidable in children with Apraxia, especially when entering active physical competition where limitations become obvious.

Because there has been only a small number of cases in which Apraxia is the outstanding symptom, research is slight. Orton mentions that some observations and results, however, are worthy of record. It has been reported that some children with Developmental Apraxia are often proficient in skills such as horseback riding and swimming because the boyd is supported without so great a need of equilibrium. Motor acts that require gross movements of the body such as walking, running, and jumping are more difficult to execute (Orton, 1937).

Developmental Apraxia is an extreme example indicating the relationship of dominance to motor skills. It is necessary to mention that the occurrence of motor intergrading is by no means a fixed measure of the ability to acquire manual skills. Orton (1937) views it as

> evidence of the absence of a sufficiently strong hereditary tendency to establish a clear-cut selective preference for one side in all motor acts but since such intergrading will include all degrees of intermixture there will be many individuals who exhibit some evidence of mixed sidedness and yet who have met with no difficulty in acquiring either complex motor acts or spoken or written language. (Orton, 1937, pp. 62-63)

The group with mixed or confused patterns indicates the existence of an inherent variable. If this is true, then there would be a graded series of sidedness ranging from very strong left to very strong right with all degrees of intermingling in between. This assumption could explain why it is much easier to train one individual to switch sides (for example, insisting that a "lefty" use the right hand for writing) than it is to train another, or why an individual will revert back to the natural side after being trained on the less dominant side for a specific skill.

Basis for Training

Before suggesting possible ways of training a child to develop dominance, necessary questions to consider are these: If confused or mixed dominance implies the possible existence of an inherent variable, then is it actually possible to train a person to develop lateral dominance? If it is possible, is it beneficial or even necessary?

As mentioned above, there are two theories regarding the development of lateral dominance. The first proposes that it is inherited. This belief was quite popular a few decades ago and is supported to some extent by Orton (1937). The second theory is that it is totally developmental and is influenced by social and/or emotional pressure. All normal children can develop either a right or left dominance with appropriate training from birth. This idea is supported by human and animal studies where limb preference has been altered through behavior manipulations (Coren and Porac, 1977). If lateral dominance is not inherited then it is obvious that training will have a direct effect. However, the writer tends to agree somewhat with Orton in that there is the possibility of the existence of an inherent variable and there also exists various environmental factors that tend to influence sidedness.

In some cases, training can have an effect on the development of lateral dominance. An example of this is the case of a boy, a right-sided individual, who pole-vaulted with his left side. He did this because prior to his attempting to pole-vault, he observed a pole-vaulter who was left-sided and very skilled. In his imagination, the boy saw himself pole-vaulting as the left-sided individual did so. When the boy took up the sport, his coach encouraged him to do it with his right side since the right side was dominant, but to no avail. The boy had

fixed the motor pattern through contemplation and he vaulted with the left side (Orton, 1937). This shows the relatively small amount of influence required to cause a change of pattern in some individuals. It also suggests that, accepting the existence of a graded series of sidedness, the boy was not extremely strong right and this resulted in his ability to pole-vault with his left side.

There have also been cases reported in which training has not been successful in encouraging a person to use the opposite side. There exists a group who show a strong tendency for either right or left and they persist in their natural tendency to use the dominant side regardless of environmental factors. An example is that of an individual who being totally left-sided is trained to write with the right hand. When the pressures of training are eventually absent, the individual reverts back to the left side because it is quicker and easier (Orton, 1937). On the graded series of sidedness, this individual would be considered to be extremely left-sided because environmental influences could not change the natural tendency.

Benefits of Training

The group of individuals for whom training could be beneficial and perhaps extremely important are those who are neither extremely left nor right sided. These are the people who have difficulty deciding which side to use for

specific motor skills. They tend to be easily influenced by training and other environmental factors. Those persons from this group who seem to tend toward the left side will probably have more problems with motor skills than those who tend toward the right. The main reason for this is the fact that it is difficult to be left-handed in our culture. Jon Durkin of the Johnson O'Connor Research Foundation in Washington, D.C. stated that "It's bad enough to be left-handed, but being left-eyed and right-handed is even worse. You've got a little war going on inside" ("New Findings About," 1977, p. 33). Therefore, having mixed or confused dominance is much more difficult than being totally left-sided. However, being left-sided or tending toward the left side definitely has disadvantages.

The left-hander is frequently supposed to learn how to throw, catch, bat, kick, etc., by watching a right-handed person. Some have even gone so far as to call the "lefty" a member of a minority group (Oxendine, 1968). In addition, lack of success, lack of appropriate facilities or equipment, and efforts to subdue the preferred hand may result in some children developing emotional or motor development problems (Oxendine, 1968). The problems children may or may not encounter depends upon where their right/left tendencies lie on the graded series of sidedness ranging from very strong left to very strong right with all degrees of intermingling in between.

It has been noted that persons with mixed or confused dominant characteristics (right-handed and left-eyed or left-handed and right-eyed) may have certain physiological and psychological difficulties throughout life. Some scientists believe that an awareness of this trait can explain such things as awkwardness, learning disabilities, and a generally poor physical condition ("New Findings About," 1977). Doman and Delacato (1963) also reported that individuals with no clear dominance and with little motor skill exhibit more severe problems than do persons with either a right or left dominance. Oxendine (1968) cited a report of Durost (1934) which stated that left-handedness is linked with reading problems, stuttering, stammering, and a lack of physical coordination. These conditions resulted from both neural confusion and environmental pressures.

There have been countless studies done on the relationship between mixed dominance and reading. These specific studies were cited because they also show a possible link between mixed or confused dominance and motor proficiency.

Training Techniques

A controversial motor development approach for developing lateral dominance is the "patterning" theory of neurological organization developed by Doman and Delacato

(1963). This is an extensive program and must start at the lowest brain level at which an individual exhibits disorganization. Delacato believed that the concept of laterality should extend to the whole body and not be limited to measures of laterality that test only handedness.

At the highest level, neurological organization is diagnosed by observing whether the child has established a clear dominance on one side of the body. Mixed dominance is evidence of poor neurological organization. At the second highest level, the cortical level, neurological organization is evaluated by observing whether the child walks with good balance, smoothly, and in a cross-pattern manner. Also at this level, smoothness of movement of the eyes in visual pursuit is indicative of good neurological organization. The third level is that of the mid-brain where creeping is the source of evaluation. Neurological organization is indicated by smooth, cross-pattern creeping and smooth eye movement during visual pursuit of an object held in the child's hand. The final level, and the lowest level evaluated, is the pons. At this level, neurological organization is indicated by a sleeping position appropriate to the child's laterality. Training is then begun at the lowest level where disorganization is shown. The basic training consists of sleep posturizing, cross-patterned creeping, and cross-patterned walking. Eye training is also included at the various levels (Delacato, 1963).

Delacato's training program involves much diagnosis and extensive treatment. The theory of neurological organization is interesting and has contributed toward a better understanding of child development. However, this theory has not been widely accepted. This is partially due to the faults in design and analysis of many of the experiments. Many critics feel that there are too many uncontrolled variables in Delacato's experiments to make them reliable (Robbins and Glass, 1967).

A leader in the field of motor development in children, Kephart (1968) believed that normal perceptual motor development helps a child establish a stable and reliable concept of the world. Since a child's first learnings are motor learnings, it is this stage of development that lays the foundation for further development. Four motor generalizations are discussed by Kephart. He stated that a child without lateral dominance would have difficulty with all stages. The four motor generalizations which are considered necessary for success are balance and maintenance of posture, which involves activities to help a child handle the force of gravity and manipulate the body accordingly. The second is contact whereby the child learns through the manipulation of objects which in turn helps develop skill in form perception and figure-ground relations. Locomotion is the third motor generalization which allows the child to

see the relationship between two objects in space. At this stage the child explores space through creeping and crawling. The final motor generalization is receipt and propulsion whereby the child learns about the actual movement of objects in space through various motor activities. Receipt refers to the movement of objects coming toward the child and propulsion refers to the movement of objects being pushed away. It is at this level that the child investigates lateral movements (Kephart, 1971).

There are other motor theories of value and interest other than those mentioned above. A few worthy of attention are the visuomotor theory of Getman (1965) which emphasizes the role of vision and visual perception and the movigenic theory of Barsch (1967) which is based on his belief that learning difficulties are related to the learner's inefficient interaction with space.

A developmental motor training program would undoubtedly benefit most young children and especially those who exhibit difficulty with a particular stage of development. Those who show difficulty with body image and laterality will probably be more susceptible to the development of mixed or confused dominant patterns. The children who are especially at risk for learning problems are those who do not develop a strong right or strong left side.

Natural Development

Children should be allowed to develop maturally. Attempts made by outside forces to encourage a child to be

either right-sided, left-sided, or "ambidextrous" can give rise to difficulties. This is especially true during the two critical periods of language development, between the ages of two and three, and six and eight. Evidence has revealed that a shift of handedness enforced by an injury to the right arm of a right-handed adult will have no demonstrable effect on speech. However, a comparable situation arising during one of the two critical periods will very possibly be followed by a speech disorder (Orton, 1937).

Regarding those children who do not develop a selective skill on either side, it is probably best to increase the skill and the habit of use on the side which seems to have the greater capacity--if this can be determined. When the balance is equal, preference is given to the training of the right side (Orton, 1937). But those who show an early distinct preference for one side should be left alone to develop it. If a child shows a strong natural tendency for the left side, it may be necessary to acquire special equipment (scissors, tools, etc.) for the child to use in order to assure that the left side becomes dominant.

It is not as difficult to be left-sided in society today as it was in the recent past. Various materials are available for left-sided people. An example exemplifying a problem that was quite common is that of an individual who was left-handed in all activities except golf. He could not locate left-handed golf clubs so had to use right-handed golf clubs. It was difficult for him to learn

and he confessed that it was his poorest sport (Orton, 1937). Had the individual has access to left-handed golf clubs, the learning experience would undoubtedly have been easier and more pleasant. Also, he possibly may have excelled in the sport.

There have been instances in which people have tired to train for "ambidexterity," not realizing that human development in manual skills reveals a tendency for the preferential use of one hand. Some children who do show a high degree of ambidexterity commonly show less than the usual skill for their age in the more intricate movements of either side. As mentioned above, a so-called ambidextrous person is usually a native sinistral (Orton, 1937).

Training for Apraxics

In spite of extensive training done with people who exhibit Developmental Apraxia, there still remains a strong suggestion of an even balance between the two sides. Motor tests also reveal an amphiocularity or lack of ability in monocular sighting with either eye. Keeping in mind that apraxics often show proficiency in sports such as horseback riding and swimming, it would benefit them to encourage those types of activities rather than expect them to perform in areas where gross body movements are required such as with running and jumping. Most children easily acquire the largely reflex patterns of movement without training and

so need only special instruction in order to participate in more difficult sports such as tennis. But for a child with a measure of Apraxia, this assumption cannot be justified. More headway is made by teaching the child how to run and turn and stop without losing balance before specific training in a sport is begun. Parents of such children should realize that this can be a real disability and not merely the result of carelessness. The best attitude for a parent to adopt could be that of tolerant amusement along with sympathetic instruction for the correction of the disability (Orton, 1937). The acquisition of skills is arduous for an apraxic, but certain skills can be mastered with sufficient learning and practice. Sometimes accomplishment in another manual craft will help compensate for the more general awkwardness. In addition, success in the scholastic area can serve as a recompense for failures in athletics. The self-concept of the child must be kept in mind at all times, as is true of all children. Each needs to experience the personal satisfaction that success can give.

Summary

Chapter II presented a review of the research regarding mixed or confused dominance and its relationship to gross-motor skills, mainly in children. Background information on the brain was presented, emphasizing the separate

functions and possible capabilities of the two sides of the brain. A discussion about split-brain experiments aided in acquiring a basic understanding of the brain.

Various beliefs regarding hemispheric specialization were presented, particularly those of Zangwill, Orton, and Kinsbourne. The controversy regarding cerebral dominance and sidedness is a continuing one. The research suggests ways of possibly determining cerebral dominance and conflicting ideas regarding its onset.

Lateral dominance, which is much easier to detect than cerebral dominance, is mentioned. Basically, there are two theories regarding its development: namely, that it is inherited or developmental.

The writer discovered that there is a limited amount of information directly relating mixed dominance and gross-motor skills. Research has shown, especially through the work of Kephart (1968, 1971), that an adequate body image is vital to the successful motor development of a child, and lateral dominance is related to body image.

The writer struggled with the terms mixed and confused, referring to dominance. An interesting distinction was made between the two terms.

The condition known as Developmental Apraxia was discussed. Those having developmental apraxia seem to lack

any sense of lateral dominance which is perhaps related to a lack of established cerebral dominance.

Finally, questions regarding the possibility or necessity of training for the development of dominance were stated. These questions were based on the assumptions of the existence of an inherent variable and the presence of environmental pressures and influences. Many references were made to Orton and Oxendine regarding the importance of developing either a strong left or strong right side. The various problems that left-handed people encounter were discussed and mention was made of the motor theories of Doman and Delacato, and Kephart.

Various suggestions were presented for encouraging the development of lateral dominance especially for left-handed people and for those who do not show signs of developing a strong side.

Even though Developmental Apraxia is not common, the writer included various suggestions regarding ways of handling the problem in young children.

CHAPTER III

SUMMARY AND CONCLUSIONS

The concept of dominance is difficult to understand. A basic knowledge and appreciation of how the brain functions and how it controls human behavior is helpful when dealing with such concepts. If so much research has been accumulated and so many theories proposed by learned educators and scientists, then there must exist a way of transferring this knowledge into practical suggestions for the purpose of helping children develop and learn.

The various types of research on the brain, including experiments with split-brain patients and studies involving the use of sodium amytol, are extremely interesting and informative. However, there should be some practical way of applying this information. Research and experiments are of little value unless they can improve the human condition.

Practical Application

Research states that it is safe to assume that a totally right-sided individual would be left lateralized for language. But it is not safe to assume that a totally

left-sided individual would be right lateralized for language. Studies of the brain indicate that the non-dominant hemisphere also has some language capabilities and it is a well-known fact that in young children, the brain is capable of transferring information from one side to the other. So it appears that there are no absolute truths to rely upon when trying to determine how the brain functions.

The observation of one's lateral preferences (hand, eye, and foot) is the only obvious indication there is regarding cerebral dominance. Lateral preferences are often indicative of the dominant hemisphere--but not always; and it is impossible to know in which cases it is so.

The behavior of children can be observed and behavior can communicate various characteristics to a careful observer. Because cerebral dominance cannot be positively determined, it is best to allow a child to develop naturally. This means that a child should not be encouraged to be right or left-sided by outside forces unless it is a natural tendency. If a child exhibits signs of being either left or right-sided, it is best to encourage the use of skills on the seemingly dominant side. If a dominant side cannot be determined after an extended period of careful observation, then preference is given to the dominant development of the right side.

This paper proposed the possibility of children with mixed or confused dominance having inadequate gross-motor

skills. The writer believes strongly in the assumption that a child who has not established lateral dominance will exhibit mixed eye, hand, and foot preferences. This will undoubtedly lead to inadequate gross-motor skills. If the two sides of the body do not complement each other, with one exerting a dominance over the other, the child will probably experience indecision and confusion when confronted with a motor task. This lack of body image and established dominance will have a negative effect on the child's self-concept. The problem then becomes more difficult to deal with.

Wheatley (1978) suggested that our educational system encourages left brain work such as language, writing, math, and logical reasoning; and it tends to minimize the capabilities of the right brain. This may be true to a certain degree. The writer suggests that our educational system does not emphasize the development of motor skills as much as it encourages and praises achievements in the strictly academic areas.

The Importance of Motor Skills

It must be remembered that a child's first contact with the world is through movement. The child's first learnings are motor learnings. If failure is experienced at this level, then it may very well affect ability to learn in the future, even in areas where a developmental

disability would not otherwise exist. A functional and adequate body image is beneficial if a child is to develop a good self-concept. A child needs to feel secure while experiencing the outside world through movement.

Once the child enters the school setting, motor skills become extremely important. A youngster with inadequate motor skills will not be chosen to play games (or may be selected last) and this can have a devastating effect on personality and emotions. It is also important that a child who excels in the motor area be acknowledged for that particular skill. Too often, schools and parents give little notice to and recognition of an "A" in physical education and place the emphasis for achievement on the more academic areas of reading, writing and math. This can have a negative effect on the self-concept of a child who tends to express the self through movement rather than in the more "intellectual" ways.

The writer has stated, in other words, that all children have unique modes of expression. They should be encouraged to express themselves in the ways that are natural for them. If allowed to develop and learn without a lot of limitations and restraints, there would be fewer children with developmental disabilities and those experiencing such problems would be easier to help.

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